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ABSTRACT

This paper outlines the current status and future developments in interactive distance education by both the telephone and cable television (CATV) companies in Connecticut in the wake of an ongoing infrastructure evaluation. The first of the activities described is a two-year interactive, distance education trial program entitled "Links to Learning," which was marketed, implemented, and monitored by Southern New England Telephone Company (SNET). It is noted that the project used an advanced voice messaging system, a packet-switched network, and two interactive, full and compressed motion video systems to connect parents, teachers, administrators, and students to the educational network. Multicultural emphases of "Links to Learning" using a bi-directional video link are also described. The state's K-12 Instructional Television Fixed Service (ITFS), which provides professional development and inservice training, is then described. It is conjectured that StateNet, a partially functioning copper and fiber optic cable network designed to connect all state agencies with voice, data, and video carriage capability, will be the most important future component of Connecticut's telecommunications infrastructure as new local analog and digital access facilities replace the state's existing network transport facilities. Functioning distance education programs operated by four Connecticut cable television operators are also described, and participation by two high schools in the Scistar science curriculum is noted. A discussion of the future role of fiber optic cable concludes the paper. Appendices include a list of equipment costs and a diagram of a distance learning classroom. (Contains 22 references.) (BBM)

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Telecommunications Infrastructure Modernization and Interactive Distance Learning in Connecticut

A Paper Presented to the Educational Resources Information Clearinghouse on Rural Education and Small Schools

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May 1, 1992

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)"

The state of Connecticut, under the auspices of the Department of Public Utility Control, (DPUC) is currently proceeding with a comprehensive modernization of its telecommunications infrastructure. The study is designed to assess the future telecommunications needs through a management audit of the modernization objectives of Connecticut's three local exchange carriers.1 The purpose of this paper is to outline briefly the current status and future developments on interactive distance education by both the phone and cable television (CATV) companies in the wake of the ongoing infrastructure evaluation.

CATV Companies and Distance Learning

The primary agents for distance education activity in Connecticut have been the Southern New England Telephone Company, (SNET) the state's dominant local exchange carrier, and several Connecticut cable television companies. The state has 26 licensed cable operators. Four systems presently have operational distance education programs: Continental Cablevision of Connecticut, Cox cable of Greater Hartford, and Cablevision of Southern Connecticut, and Haystack Cablevision. Four other Connecticut CATV operators, United Artists of Plainville, and Comcast Cablevision of Danbury and Middletown, and Storer Communications of Clinton, Inc., are planning to provide interactive return lines to their respective franchise area high schools.2 Continental Cablevision of Connecticut has had its interactive program functioning since January, 1987, well before the extant infrastructure initiative.

SNET's "Links to Learning"

On the telecommunications side, SNET marketed, implemented and monitored a two-year interactive, distance education trial program entitled "Links to Learning." This experimental paradigm, begun in September, 1988, and completed in June, 1990, involved SNET and the Connecticut Department of Education. The project used an advanced voice messaging system, a packet switched network, and two interactive, full and compressed motion video systems to connect parents, teachers, administrators, and students to the educational network.3 The trial also enabled the sharing of teacher talent and facilitated curricular expansion for elementary, middle, and high school educators.

SNET based the objectives of its Links to Learning protocol on bringing the benefits of the public switched network to the educational milieu. The company made available Information Age services through voice, video, and data links. The voice link trial permitted teachers to record messages and simultaneously transmit them to parents via ordinary touchtone telephones. SNET's data link used personal computers and the company's unique packet switched network to facilitate equitable pedagogic access to both students and teachers. Lastly, SNET'S video link permitted video teleconferencing to transmit live classroom lessons among the various participating schools using either full motion or compressed video systems. Links to Learning served 34 schools in 26 urban, rural, and suburban communities, as delineated in Table A.

Telecommunications Incentive Grant Program

Distance learning in Connecticut also makes use of the Telecommunication Incentive Grant Program. (TIG) This is a funding mechanism that the Connecticut General Assembly created in 1986 to provide monies to local school districts for allowing use of educational telecommunications. A preponderance of early TIGs were small, averaging about $23,000.00 Grants totaled nearly $252,000.00 through 1989.4 SNET has supplied full funding for this program since 1990. Since that time, the TIG largesse has awarded 36 grants to Connecticut schools. Amounts have ranged between $1,500.00 to $2,500.00.5 The program requires at least a 20% funding obligation from the local school, and participation in a summer seminar and a mid-year educational symposium.

Multicultural Emphases

Links to Learning crossed cultural barriers in its approach to learning. For example, a bi-directional video link now connects an Advanced Placement Spanish language high school class in a suburban town with an advanced class of Spanish speakers in inner city Hartford. This link is similar to Texas' Project Bluebonnet. According to Southwestern Bell, its emphasis is on "...the use of advanced networks and high quality equipment to provide two-way full motion interactive video and audio among geographically dispersed classrooms."6 This is also the ultimate objective of Connecticut's distance learning protocols.

In Connecticut's case, distances were more cultural than geographic. For example, a 1988-1989 distance education trial funded by SNET and the State linked inner-city, largely black and Hispanic, Bulkeley High School with predominately white, suburban, Hall High School. Teachers from each school volunteered to conduct the pilot run using a compressed video system to deliver Advanced Spanish classes to each facility. According to SNET's Kathy Buccy, co-director of the Links to Learning Project, this program "...use(d) our telecommunications resources to serve their needs-two different schools, two different facilities linked by the need to share knowledge."7 The overarching emphasis is on sharing teachers and other educational resources across school districts.

Connecticut's K-12 Instructional Television Fixed Service

The state's K-12 Instructional Televison Fixed Service (ITFS) constitutes yet another integral distance education component. The initiative was planned and designed to augment the extant community college ITFS network under the direction of the Department of Education. The network became partly operational in 1989, first providing distance transmission that year. Curricular areas covered included professional development and in-service training. Twenty-five school districts have been served since 1989.8 The Connecticut ITFS architecture will, upon completion of microwave towers sometime in 1993, provide the advantage of the shared resources of a statewide telecommunications system.

StateNet

Possibly the most important future component of Connecticut's telecommunications infrastructure is StateNet. The DPUC initially approved this partially fuctioning cooper and fiber optic cable network in 1989.9 A collaborative effort of the Office of Policy Management and SNET, the network is designed to connect all state agencies with voice, data, and video carriage capability, possibly including educational trafffic. Voice and data communications transport will be over SNET's fiber optic backbone via digital and enhanced analog transmission facilities. The network's new local analog and digital access facilities will eventually replace the state's existing network transport facilities.

CATV and Legislative Initiatives

Connecticut's 26 CATV operators are becoming more proactive with respect to interactive distance learning. Extant legislation has helped provide an impetus. Specifically, Sections 16-333(g) and 16-333(h) of the Connecticut General Statutes require cable television companies to proffer at least one educational access channel in their programming line-up.10 The statutes also specify that public libraries serving the operator's franchise area are to receive free basic cable service.

Cable-Related Distance Learning

As previously noted, four Connecticut cable television operators possess functioning distance education programs: Continental Cablevision of Connecticut, Cox Cable of Greater Hartford, and Cablevision of Southern Connecticut.11 A fourth operator, Haystack Cablevision, has recently installed a return line to the franchise area's only high school, Housatonic Valley Regional.12 All four companies use return lines to provide the necessary bandwidths to transport signals to various centralized transmission sites. The schools generally are responsible for the purchase and upkeep of origination programming equipment used in the classrooms.

Two other CATV operators, Storer Communications of Clinton, Inc., and Comcast Cablevision of Middletown, Inc., are currently before the DPUC in franchise renewal proceedings. In both cases distance learning committments from the respective companies are key issues. Storer cable has in the past year examined interactive distance learning and found it both intriguing and doable.13 However, as Tables B and C illustrate, there is considerable expense involved, particularly with regard to the average cost per student per mile of coaxial cable as well as various types of equipment costs. Table D presents a distance learning environment as envisioned by the Valley Shore Telecommunications Cooperative, a distance education group in the Storer franchise area. Storer has agreed, following the conclusion of recent negotiations with Valley Shore, to provide one free return line to the Haddam-Killingworth High School.14 Additionally, Storer has also committed, in its April 14, 1992 filing with the DPUC, to donate $50,000.00 toward the cost of constructing the remainder of the network.15 Table E presents a coded map of the locations of the other state CATV systems.

Comcast Middletown Cable has recently concluded negotiations with the Office of the Consumer Council, a state agency representing Connecticut consumers, the company Advisory Council, and a franchise area distance education group, the Middlesex Distance Learning Consortium. These discussions focused on a DPUC order in a previous decision regarding Comcast Middletown's franchise renewal.16 The order directed the company to indicate specifically how it planned to work with franchise area educators to provide distance education to area schools. The Company's most recent distance learning initiatives filed with the DPUC on March 16, 1992, state that the Company will construct one return line that will provide distance education programming from each of the four high schools affiliated with the Middlesex Consortium. The four schools are: Cromwell, East Hampton, Portland and the Coginchaug Regional High School. The company also plans a fifth return line, from the Middletown High School. These return lines will facilitate the configuring of an interactive audio and video educational network among the five schools, and enhance the sharing of educational resources. The Consortium's overarching goal, as outlined by Kathleen Barillari, Consortium Coordinator, is the operationalization of such an interactive network.17 Comcast has agreed, pending DPUC approval, to waive the fee for the non-standard installation for the Cromwell High School return line. Additionally, the Company has agreed to construct one return line to carry live local origination programming of various civic functions from the Middletown Town Hall. Construction for these coaxial distance education lines is scheduled to begin on January 1, 1993, to be completed by December 31, 1995, contingent upon DPUC approval.

Continental Cablevision

Continental Cablevision of Connecticut has run its own interactive classroom distance education program since 1987. Continental's program is one of the most comprehensive and established in the state. Continental currently allocates six channels for educational and community based programming as well as over $500,000.00 in local access facilities and programming equipment.18 The Company's plethora of distance education resources include a $150,00.00 mobile broadcasting van.

The vehicle is available on an appointment basis to franchise area residents who are accompanied by Contintental technical personnel. The company also makes available $50,000.00 in remote recording equipment as well as a $50,000.00 grant to the franchise area community college for video production enterprises. Lastly, Continental provides area educators free cable air time, training, and production supervision for educationally related local origination programming. All distance education transmissions are interactive and bi-directional.

Science Education

Connecticut's distance learning offerings include a science curriculum, Scistar. This nationwide program was originated by the Talcott Mountain Science Center, a non-profit educational organization founded in 1967.19 The principal funding agent for the group is the Hartford-based Aetna Life and Casualty Insurance Company. Local schools also contribute funding. Scistar is an interactive satellite-delivered educational service that presents topics that are on the leading edge of science, mathematics, and science education. The program's theme for 1992 is entitled "Environments in Space." Obtaining access to the actual transmissions is straightforward. For example, an interested school pays about $950.00 for one full programming year, or $500.00 for one-half season.20 Participating schools need only a movable satellite dish, a "receive only" television set, a modem, and an IBM or IBM compatible computer. The Center broadcasts each program approximately ten times during the school year. Two Connecticut High Schools, Torrington and Putnam, are presently active in the Scistar distance learning program.

Research Observations

Recent research conducted on distance learning suggests that it is an effective and efficient learning modality for advanced placement high school level courses.21 Maturity and independent learning ability are the most necessary student criteria to emerge from distance learning research. Therefore, distance instruction seems best suited to older, self-monitoring students. Educators do sound a cautionary note on distance instruction, warning of its potential for misuse by widespread transmitting of ineffectual teaching beyond the traditional confines of classroom walls.

The Role of Fiber Optic Cable

As Connecticut modernizes and expands its cable and telecommunications infrastructure, its distance education network and concomitant broadband resources also grow.22 Fiber optic technology enables clearer signal carriage at more capacious, indeed nearly limitless bandwidths for longer distances than traditional copper and coaxial cable.23 Fiber eliminates the necessity of "cascades," short, quarter-mile stretches of amplifier-boosted coaxial cable that cause eventual signal degradation before the signal reaches the "drop" to the subscriber's home. Fiber is usually installed in a "supertrunk" line. This line runs from the Company's "headend," or point of signal transmission origination, to a distribution "hub site." From there, coaxial cable carries the transmission to nodes and eventually to the curb. Therefore, fiber use results in lower overall cable distribution plant costs, since once installed, it need not be replaced for routine system upgrades, since upgrades usually necessitate replacement of only the amplifiers. This capability therefore mitigates upgrade and rebuild cost overruns.

The progressive use of the telephone, fiber, and the coaxial cable will continue to enlarge Connecticut's classroom. The state continues to move toward the construction and ultimate implementation of an educational community such as the California State University at San Marcos, which features advanced fiber optic nodes to support voice, data, and video traffic.24 Through the collaborative endeavors of the Southern New England Telephone Company and the state's 26 CATV operators, Connecticut is in the process of fashioning an educational paradigm that will offer Information Age technologies affordably to all its school systems. Cable companies nationwide now have in their system architectures coaxial broadband links serving as conduits for billions of full motion and video image transmissions.25 Such prodigious carrying ability will make delivery of full-motion educational simulations and teleconferences as routine as traditional classroom instruction. Connecticut's ability through its local exchange carrier to deliver such enhanced options to its schools as the SNET Video Link, figures to keep this small but progressive state at the vanguard of distance learning.

NOTES

1 Southern New England Telephone Company. Infrastructure 2000. Connecticut Department of Public Utility Control, New Britain, CT.: Docket No. 91-10-06, November 27, 1991.

2 Connecticut Department of Public Utility Control, Comcast Cablevision of Middletown, Inc., Franchise Renewal Proceeding. New Britain, CT.: Docket No. 89-06-33, Late-Filed Exhibit No. 11, Sept. 26, 1990.

3 Thomas A. Buckley and Kathleen A. Buccy, SNET Links to Learning Project. New Haven: Southern New England Telephone Company, 1990.

4 U. S. Congress, Office of Technology and Assessment. Linking for Learning: A New Course for Education, Washington, D. C.: Government Printing Office, OTA-SET-430, November, 1989. pp. 63-64.

5 SNET Telecommunications Incentive Grant (TIG.) New Haven: Southern New England Telephone Company, 1992.

6 "Southwestern Bell Tells Justice About Project Bluebonnet in Texas," Telecommunications Reports, 57 (10), (March 11, 1991): 1-2

7 Linking for Learning, p.117

8 Ibid., p.118.

9 Brant Houston and Sue Kinsman, "State Puts SNET on Hold Over Probe," Hartford Courant, March 27, 1992, pp. B-1, 11.

10 General Statutes of Connecticut, Revised to January 1, 1991, Chapter 289, Title 16, Sections 16-333(g), 16-333(h), pp. 545-546. Hartford: State of Connecticut Printing Office.

11 Connecticut Department of Public Utility Control, Comcast Cablevision of Middletown, Inc., Franchise Renewal Proceeding. Late Filed Exhibit No. 11, Docket No. 89-06-33, September 26, 1990.

12 Connecticut Department of Public Utility Control, Haystack Cablevision Inc., Application for Franchise Renewal Proceeding. Docket No. 90-11-22, April 15, 1992.

13
Storer Communications of Clinton Inc., Franchise Renewal Proceeding. Docket No. 90-06-23, Brief. New Britain, CT.: October 17, 1991, pp. 8-10.

14
Storer Communications of Clinton Inc., Revised Proposal for Renewal. Docket No. 90-06-23. New Britain, CT.: Department of Public Utility Control, April 14, 1992. pp. 6-7.

15
Distance Learning Technology Primer for Administrators in the Valley Shore Telecommunications Cooperative. Higganum, CT.: Valley Shore Telecommunications Cooperative, 1992. p. 16.

16
Connecticut Department of Public Utility Control, Comcast Cablevision of Middletown, Inc., Franchise Renewal Proceeding, Decision. Docket No. 89-06-33, May 15, 1991,, p. 5.

17
Kathleen Barillari, "Letter to the Connecticut Department of Public Utility Control," Application of Comcast Cablevision of Middletown, Inc., for Franchise Renewal. Docket No. 89-06-33, New Britain, CT.: September 1, 1990.

18
Access Handbook. Continental Cablevision of Connecticut, Inc. Enfield, CT.: 1987, p. 1.

19
Donald P. LaSalle and William Dunkerly, eds., Scistar: Interactive Educational Television. Avon, CT.: Talcott Mountain Science Center, 1992, p. 1.

20
Ibid., p. 2.

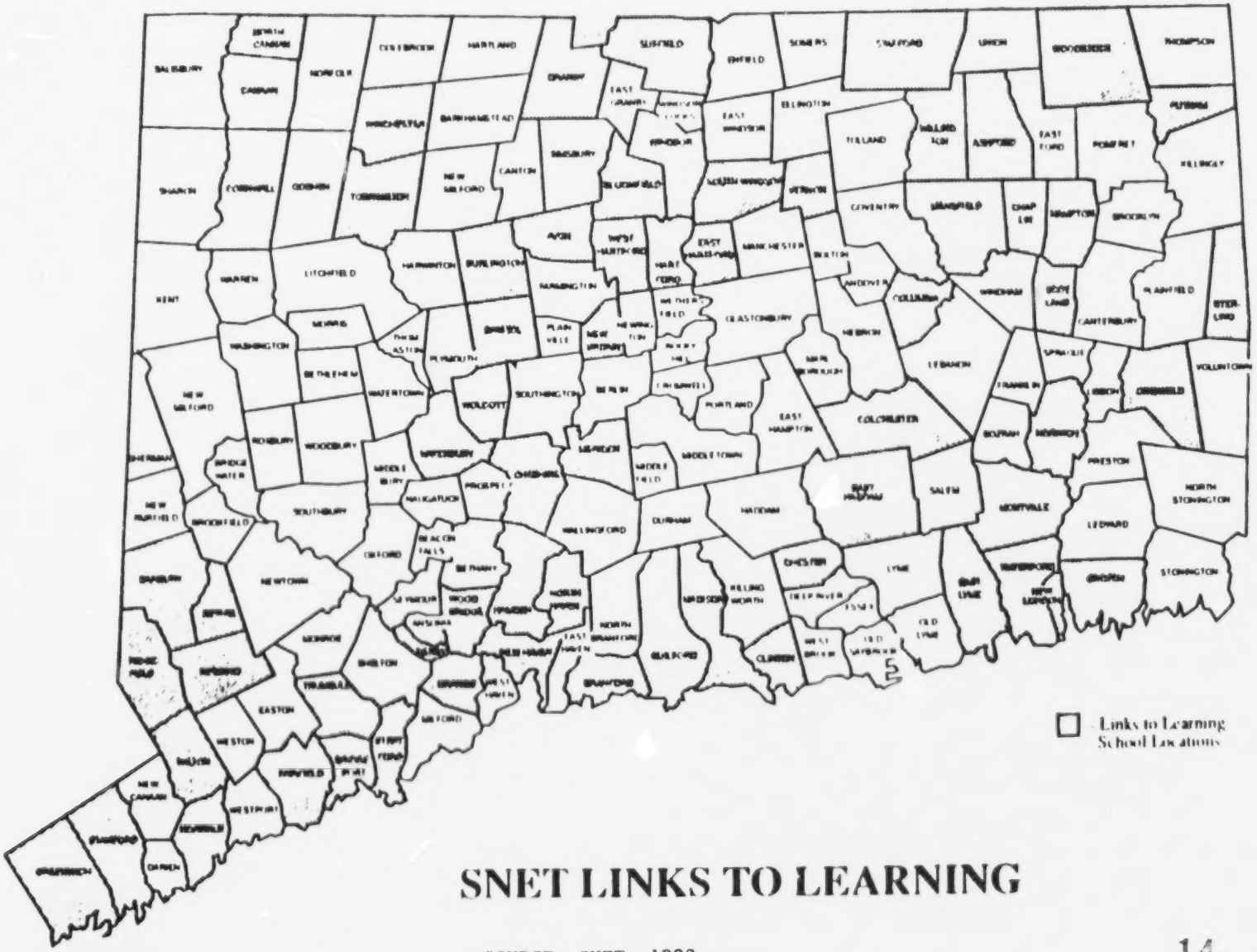
21
"Classroom Circuits," Amity Chesire-Hamden-North Haven Distance Learning Consortium,1, (1), (Spring, 1988): p. 5.

22
Connecticut Department of Public Utility Control, DPUC Review and Mangement Audit of Connecticut's Telecommunications Infrastructure, New Britain, CT.: Docket No. 91-10-06, November 27, 1991.

[23] "Cable Television: Bringing Fiber Optics to America," Washington, D.C.: National Cable Television Association, 1992. p. 1.

[24] Liz Selisker, "Unversity of the Future," Connections, 57133.20-01-92, (Jan.-Feb. 1992): p. 13.

[25] George Gelder, "Cable's Secret Weapon," Forbes, 149, (April 13, 1992): pp. 80-84.



SNET LINKS TO LEARNING

SOURCE: SNET, 1992

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TABLE B

Distance Learning Classroom Equipment

12	27" color video monitors	@ 700	$ 8,400
6	monitor brackets	@ 200	1,200
6	3" yoke pipes	@ 24	144
1	T42E cart with 5" casters		150
2	VTR20E 32" cart	@ 100	200
2	Winsted mini-frame	@ 144	288
6	flat monitor shelf	@ 83	498
2	frame extensions	@ 122	244
3	Panasonic D5000 video camera	@1,500	4,500
2	Panasonic WV CR12 controller	@ 345	690
1	Panasonic 10H-50AS 50' camera signal cable		115
2	Panasonic 10H-30AS 30' camera signal cable		114
2	Panasonic WV CA10 cable	@ 29	58
3	Panasonic WV 3203 power supply	@ 100	300
1	VCLO.5 for WVLZ14 8AF lens	@ 150	150
1	tripod with dolly		305
2	ceiling camera mount	@ 80	160
1	Panasonic active switcher WJ 220B		250
1	1/2" VHS VCR		350
1	Shure M67 microphone mixer		387
1	Crown sound grabber PZM microphone	@ 88	528
1	Shure SM 11CN microphone		90
	Miscellaneous cable, connectors, power & surge strips		600
	TOTAL: (This figure varies according to vendor.)		$15,685 - $19,551

Additional equipment requirements include outside telephone line and telephone into the distance learning classroom, computers specific to offered course, printer, and modem (depending on offered course).

Equipment can be purchased over a period of time

Year 1	Minimum receiving site	$5,375
Year 2	Full receiving site	$4,425
Year 3	Minimum origination site	$4,890
Year 4	Full origination site	$ 995

SOURCE: Valley Shore Telecommunications Cooperative, 1992

TABLE C

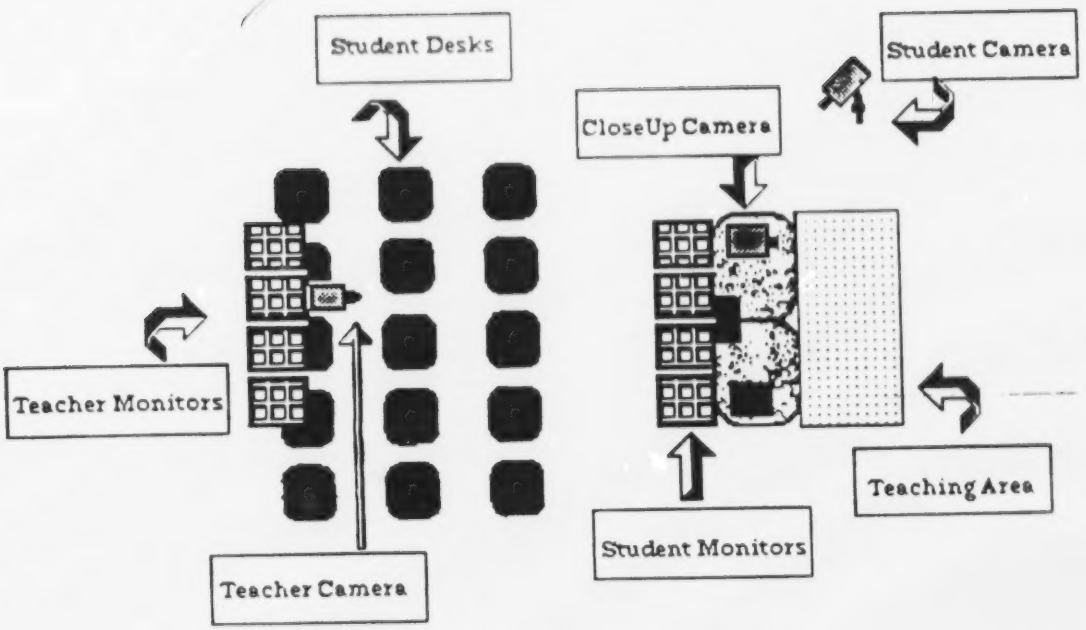
The average cost per student mile varies from district to district. As a realistic figure, we would suggest utilizing $1.25-$1.50 per transportation mile. Clearly with a minimum of ten students leaving and returning on a daily basis, these costs escalate to the point that even if they all travel to the same school for the same course (which would probably not be the case), the cost for a 180-day course would probably be somewhere between $6,500 and $9,500 for that one course alone.

While the expense and the coordination of transportation is certainly a concern, overriding that is the amount of time that would be lost by our students in other instructional areas as a result of extensive travel, and, quite honestly, it probably would mean that the students would miss their class period just before and their class period just after the individual course to which they were traveling. The net effect of this is that for a student to take one course, that student would miss three periods at his/her own school.

SOURCE: Storer/Clinton Cable, 1990

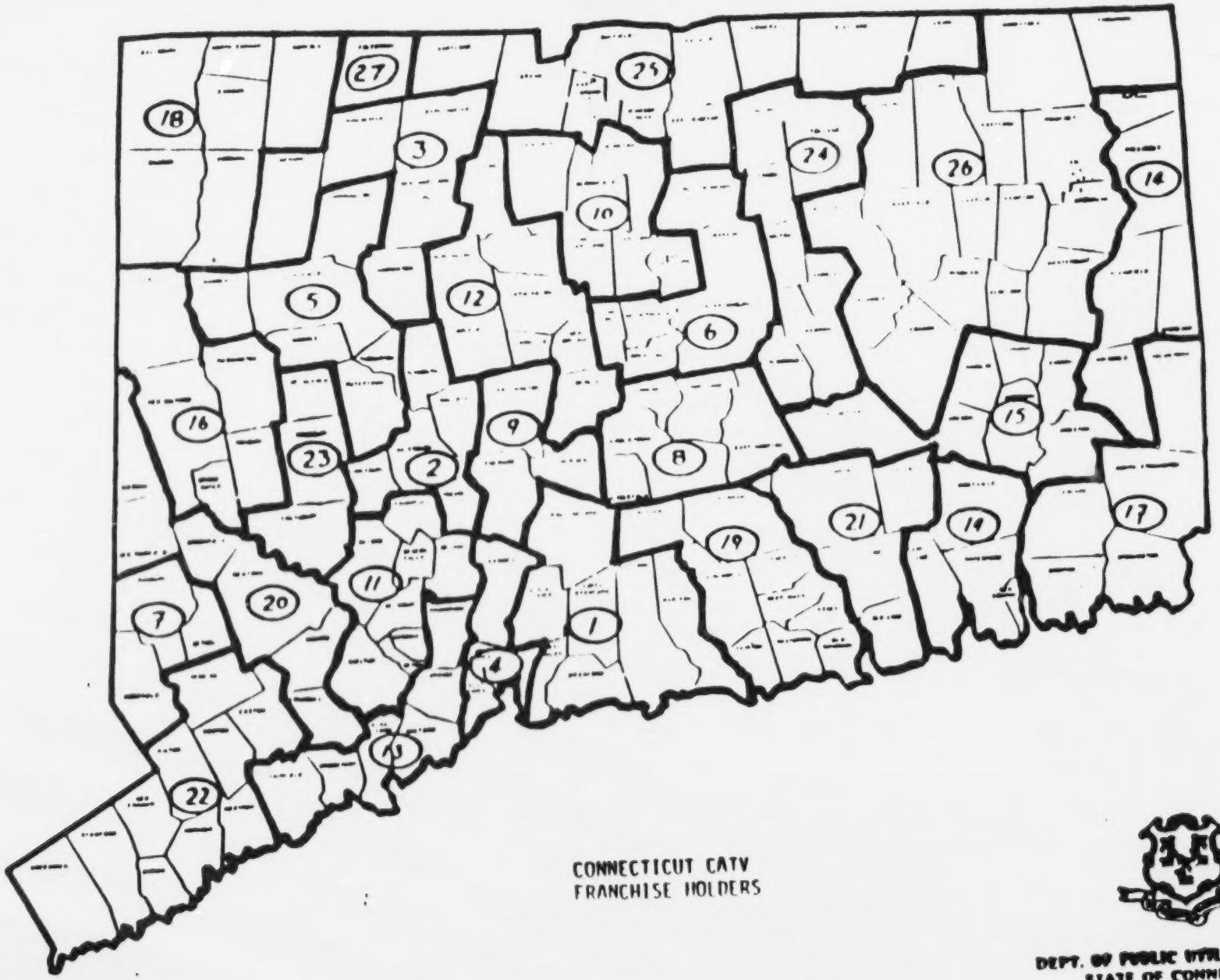
TABLE D

Distance Learning Classroom



SOURCE: Valley Shore Telecommunications Cooperative, 1992

TABLE E



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KEY TO TABLE E

CATV COMPANY	CATV CO. NUMBER
Heritage Cablevision of Connecticut	1
Sammons Communications of Connecticut	2
AMRAC Northwest	3
Storer Cable of New Haven	4
Laurel Cablevision, Inc.	5
Cox Cable of Greater Hartford, Inc.	6
Comcast Cablevision of Danbury, Inc.	7
Comcast Cablevision of Middletown, Inc.	8
Telesystems of Connecticut, Inc.	9
United Cable of Hartford	10
Valley Cable Vision, Inc.	11
United Cable of Plainville	12
Cablevision of Southern CT	13
Eastern CT Cable Television, Inc.	14
Century Norwich Corporation	15
New Milford Cablevision Company	16
Storer Communications of Groton	17
Haystack Cablevision, Inc.	18
Storer Communications of Clinton, Inc.	19
Housatonic Cable Vision, Inc.	20
Century Cable Management Corporation	21
Cablevision of Connecticut	22
Mid-Connecticut Cablevision Co.	23
United Cable of Eastern CT	24
Continental Cablevision of CT	25
Tele-Media Company of Northeastern CT	26

SOURCE: DPUC, 1992